Disturbance and Regrowth
In Biophysical Terms

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Outline

- Complementary set of analyses in biophysical space

- Why is biomass the key variable?

- What is our approach to modeling biomass and biomass change?
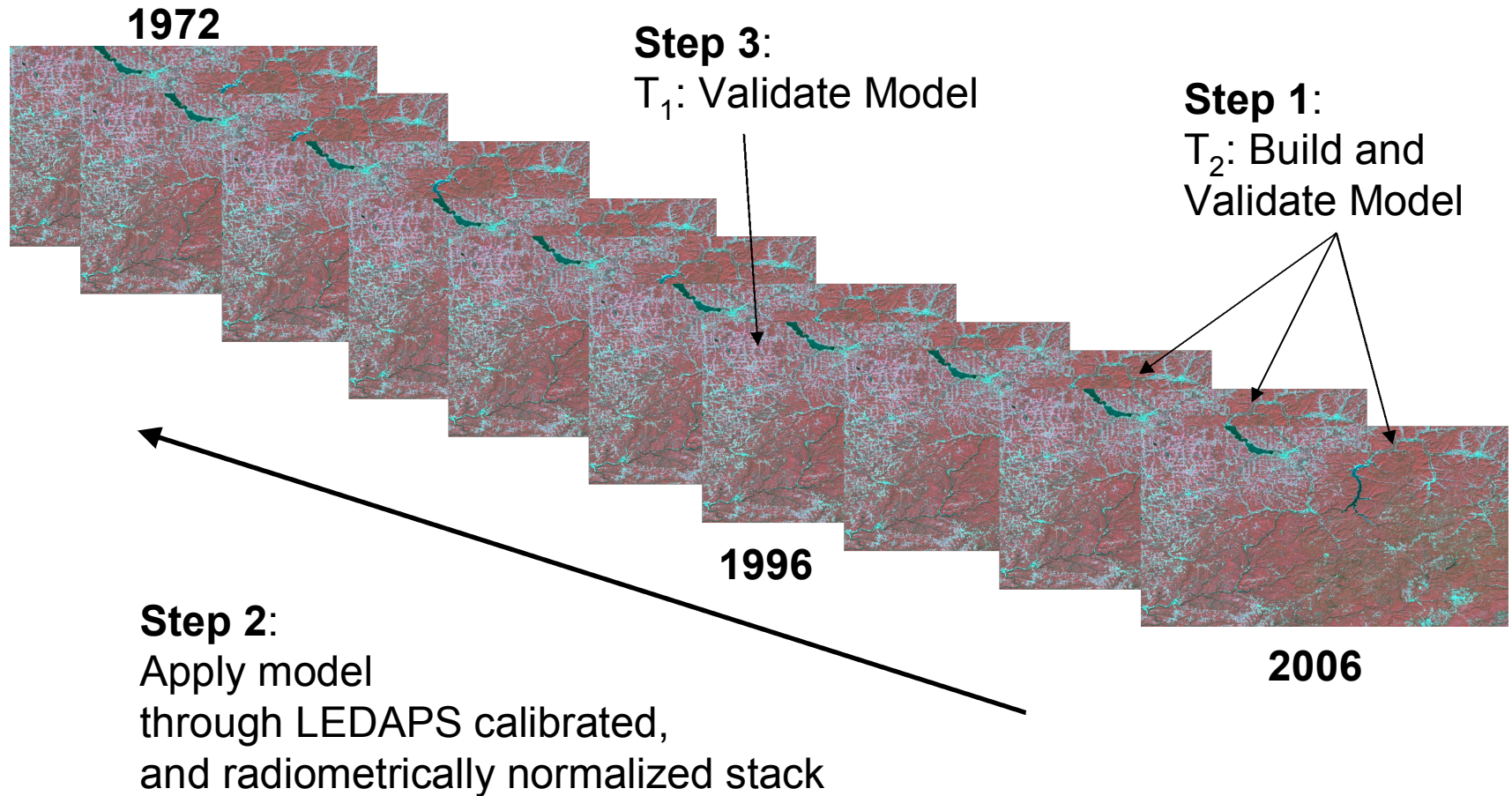
Why Biomass?

- Link data cubes with biophysical measure
- Directly related to carbon stocks and flux
  - Importance of spatially explicit biomass maps
    - Biomass lost from disturbance and rate of regrowth after disturbance
- Parameterization and validation for process-based models
- Leverages FIA data

Empirical Biomass Modeling

- Limitations of modeling biomass with single date of Landsat imagery are well known

- We are leveraging temporal density to observe biomass trends and minimize error

Biomass Modeling Approach

1972

Step 3:
T_1: Validate Model

Step 1:
T_2: Build and
Validate Model

1996

Step 2:
Apply model
through LEDAPS calibrated,
and radiometrically normalized stack

2006

Biomass Modeling Comparison

- We compared statistical modeling techniques:
  - Gradient Nearest Neighbors (GNN)
  - Reduced Major Axis Regression (RMA)
  - Generalized Additive Models (GAMs)
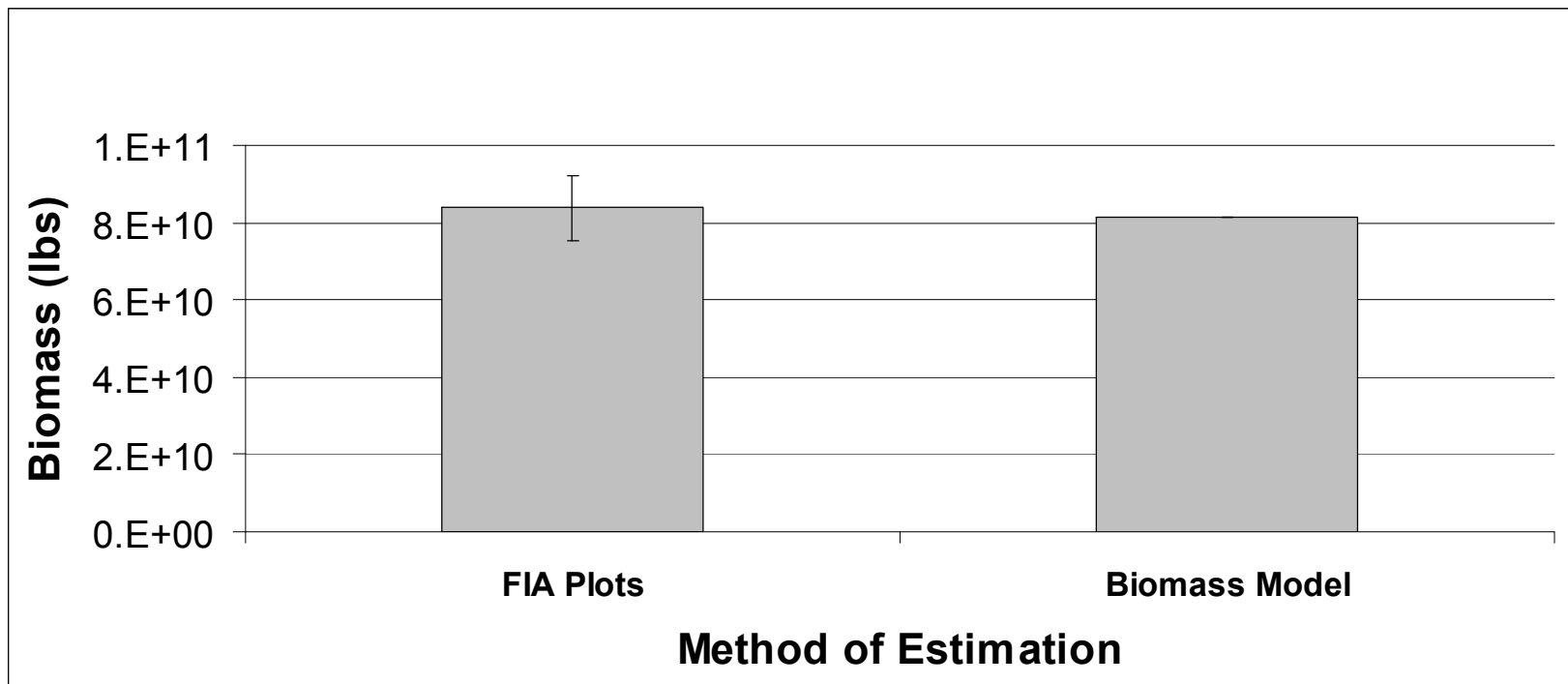 - Stochastic Gradient Boosting (SGB)
  - Regression Tree Analysis (Cubist)

Biomass Modeling Comparison

- Regression Tree Analysis

  - Most accurate models in terms of RMSE

  - Non-parametric

  - Logical interpretation
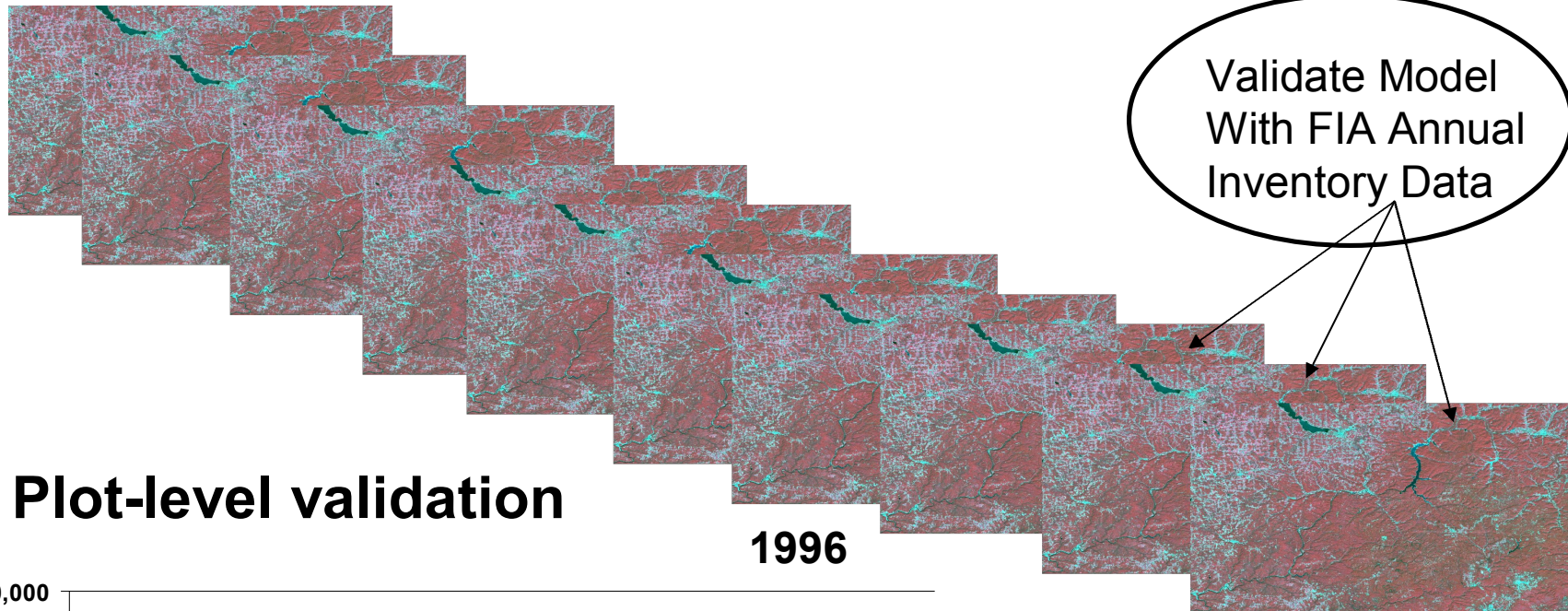
  - Easy implementation across large number of data cubes

Scene-Level Validation
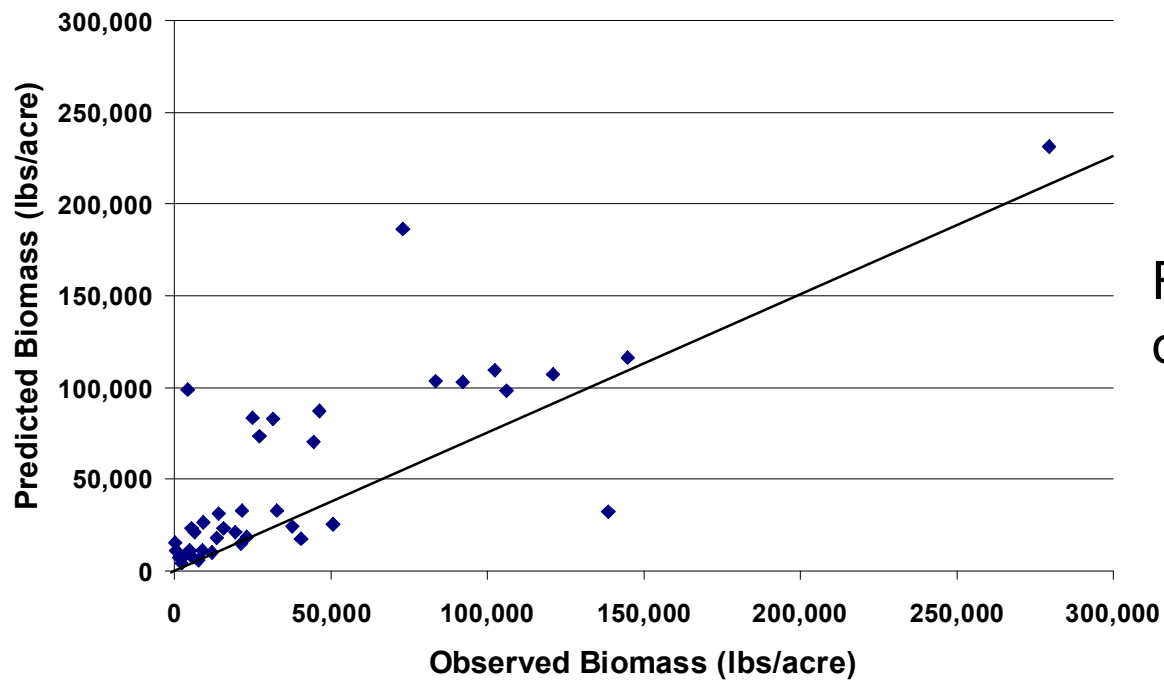# Total Aboveground Forest Biomass
Arizona 37/35

1972

Validate Model
With FIA Annual
Inventory Data

1996
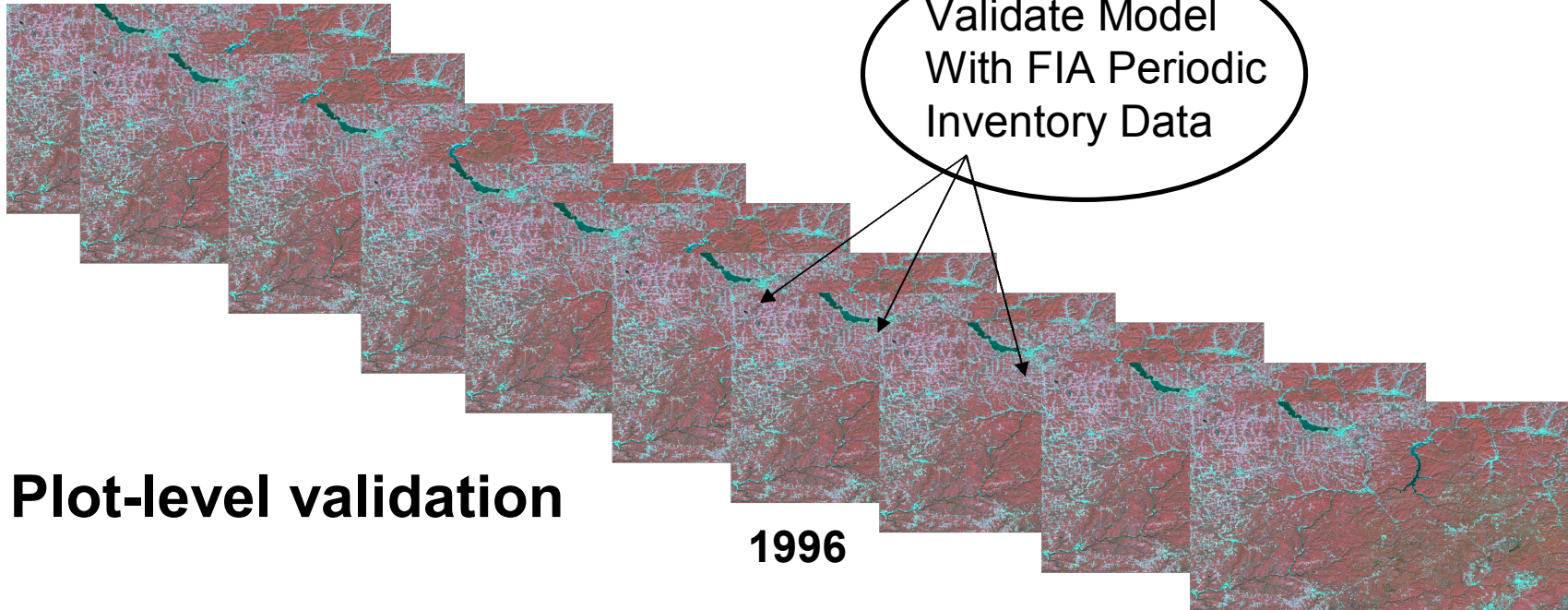
2006

Plot-level validation

RMSE = 22,786 lbs/acre
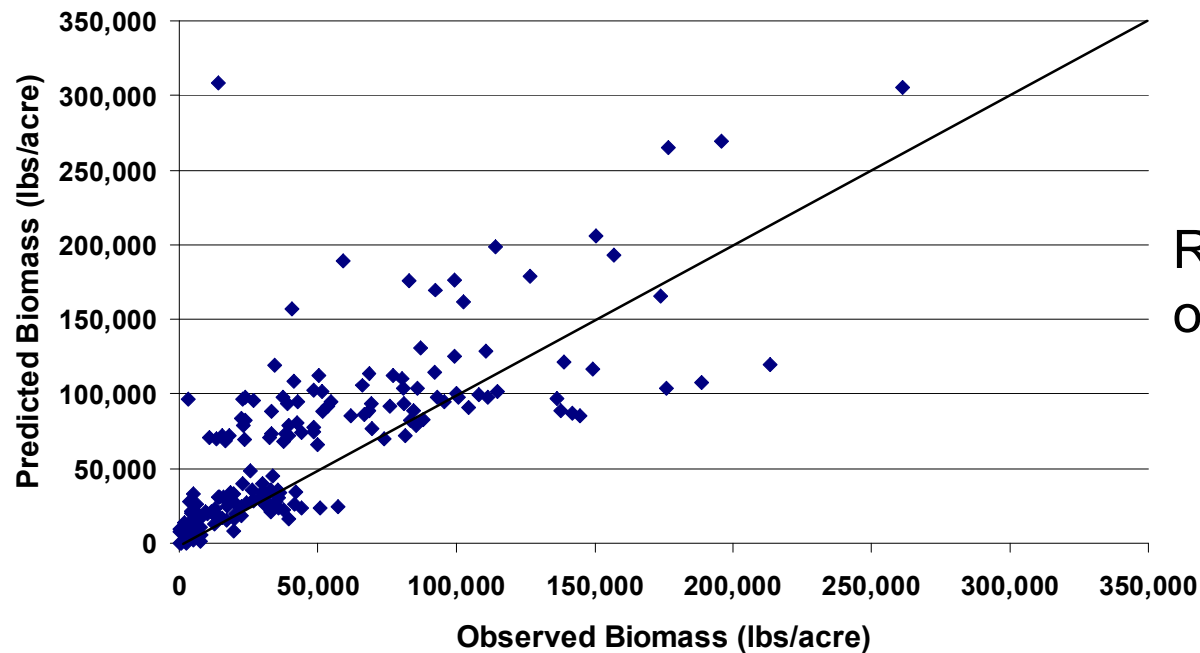of biomass

1972

Validate Model
With FIA Periodic
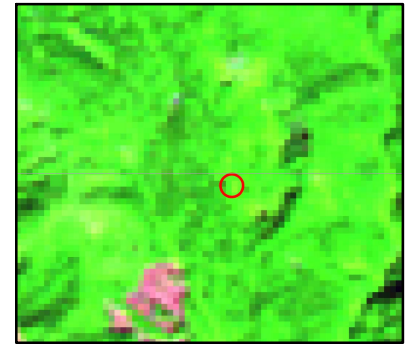Inventory Data
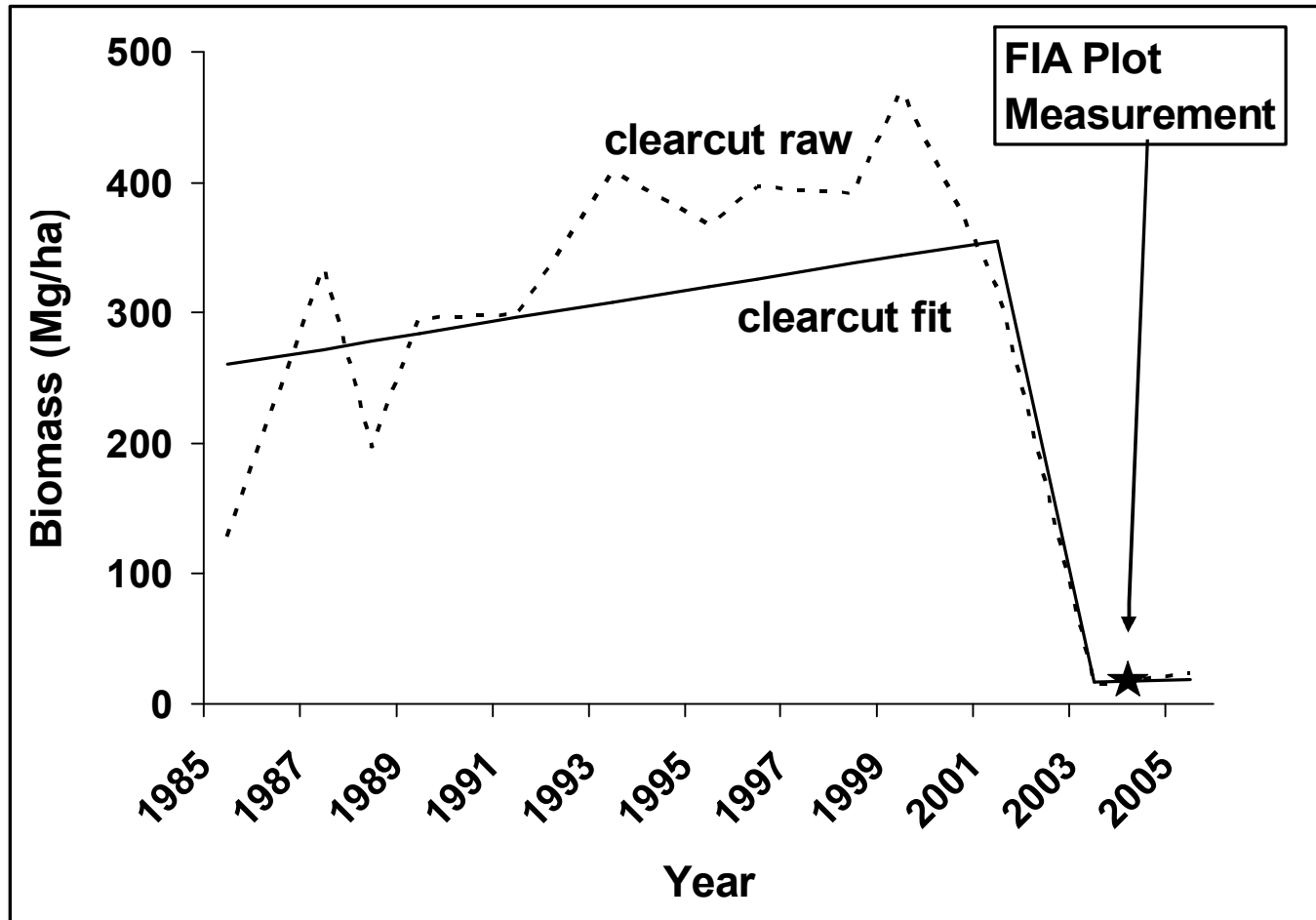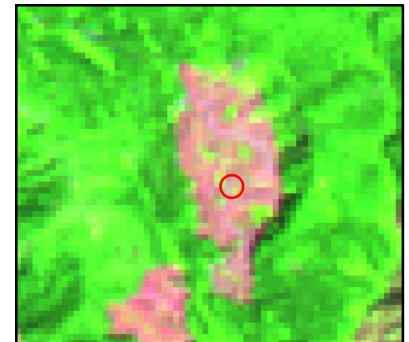
Plot-level validation

1996

2006

RMSE = 28,234 lbs/acre
of biomass
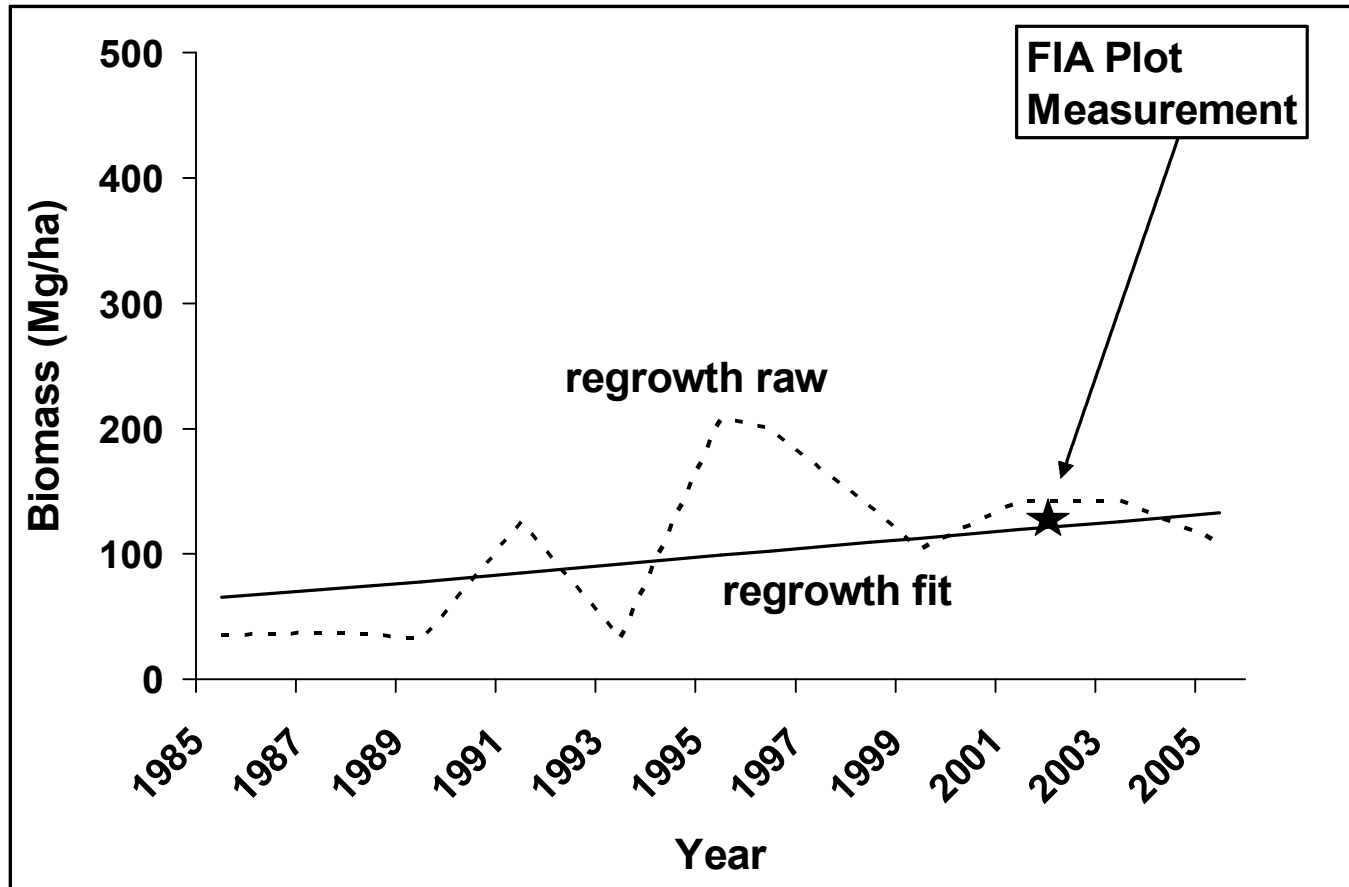
Biomass Trajectory: Clearcut

Pre-Clearcut

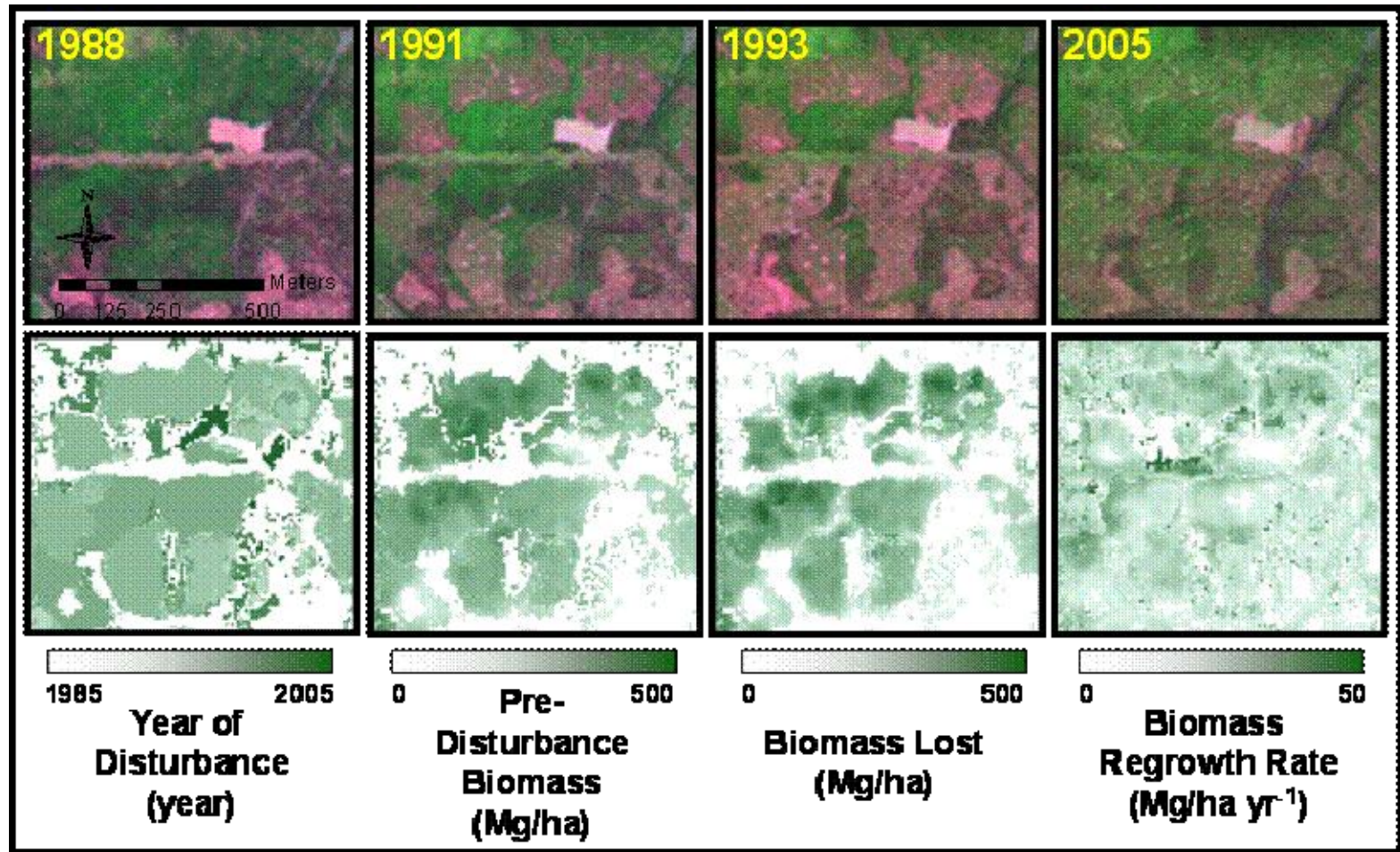Post-Clearcut

Biomass Trajectory: Regrowth

Regrowth in 1985

Regrowth in 2005

Biomass Trajectory-Based Change Detection: Outputs

Summary

- Modeling biomass through time increases the carbon relevance of the disturbance and regrowth analysis

- This is made possible by linking FIA data, the dense Landsat time series, and trajectory-based change detection